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(71) Applicants
Glover Webb & Liversidge Limited,
Hamble Lane, Hamble,
Hampshire SO3 5NY
(72) Inventor
John Thomas Pearman
(74) Agents
Mewburn Ellis & Co.,
70—72 Chancery Lane,
London WC2A 1AD

(54) **Raising and tipping mechanisms**

(57) A lifting and tipping arrangement for refuse bins has means for handling two different patterns of bin. Two lifting and tipping devices (2) for a smaller form of bin are arranged side-by-side and are operable individually by separate drive means. The frames (8) of these devices and their tipping drives (54) can be interconnected so that they operate jointly to lift and tip a larger form of bin.

FIG.2

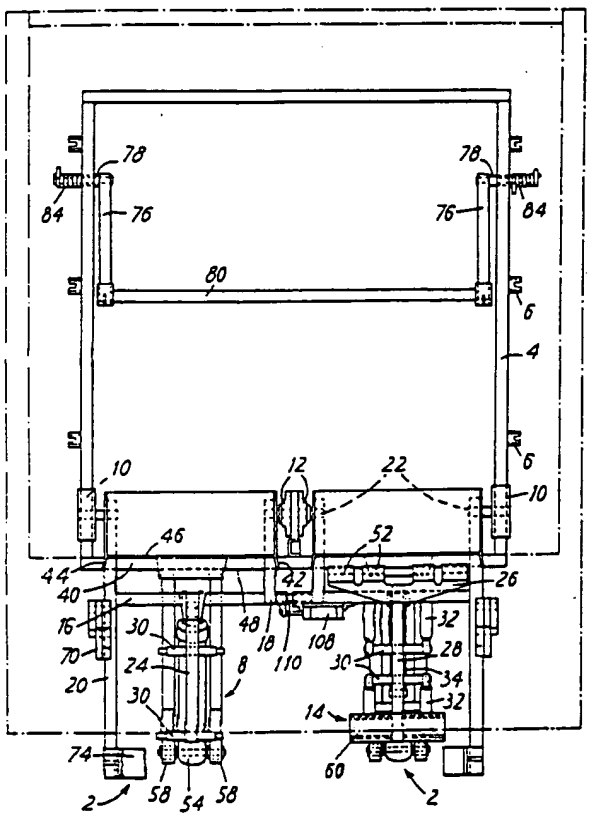

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FIG.1

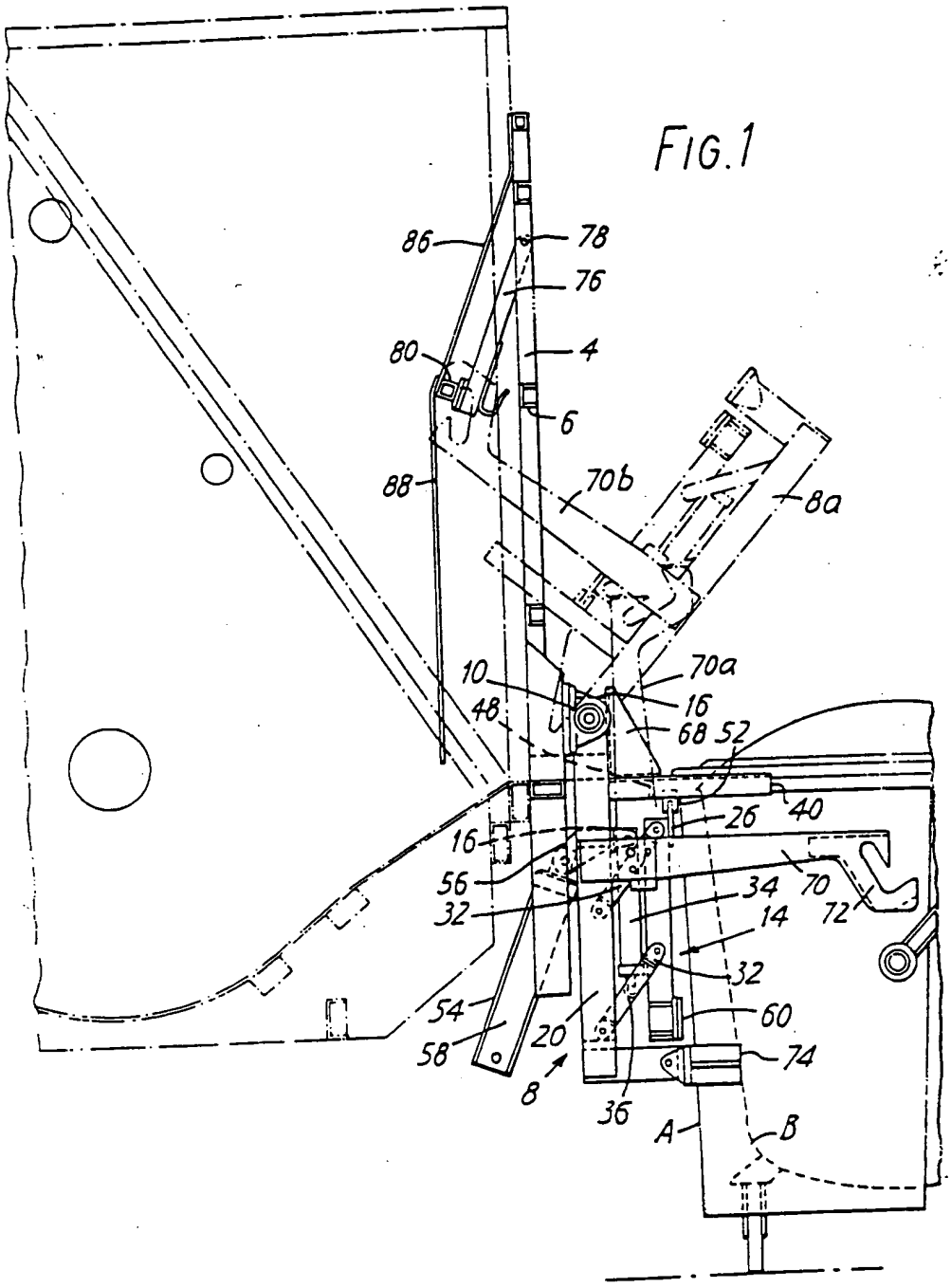
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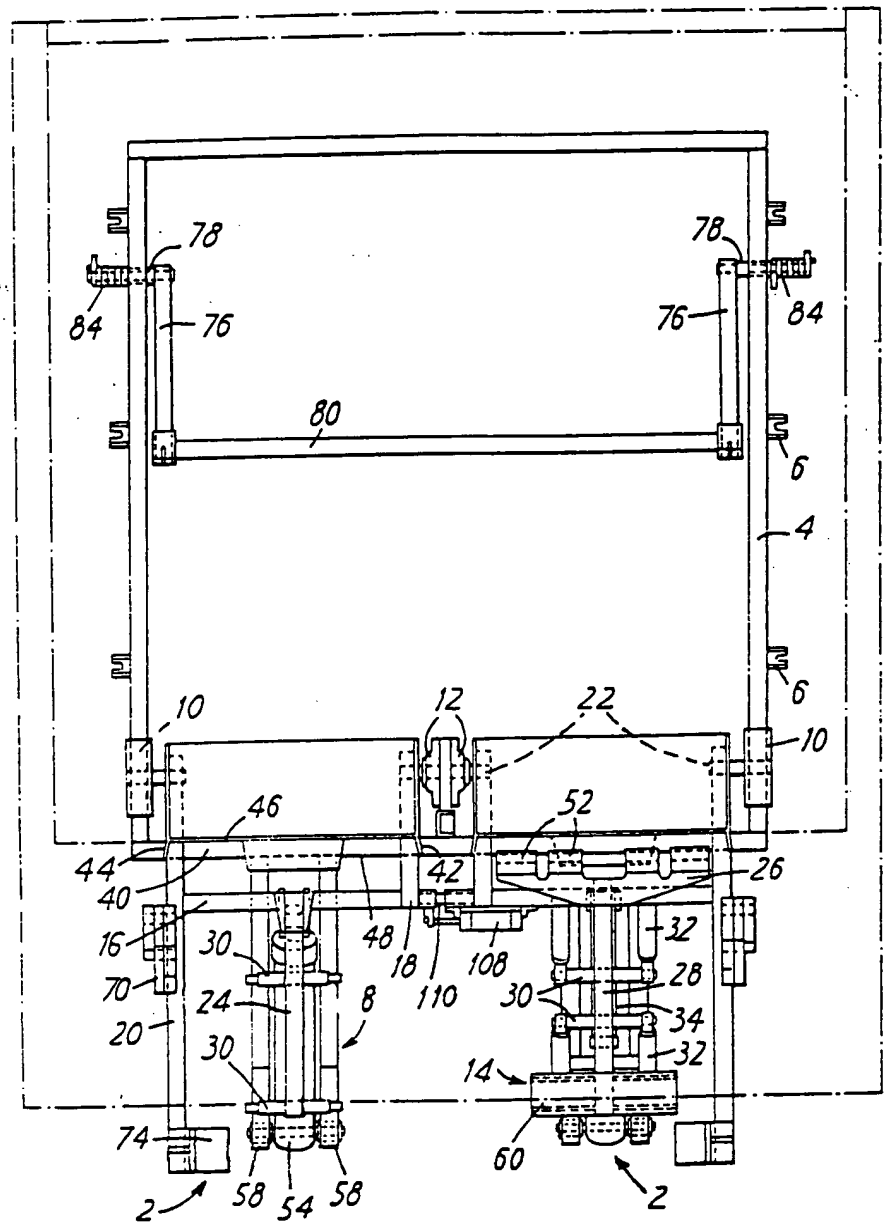
FIG. 2



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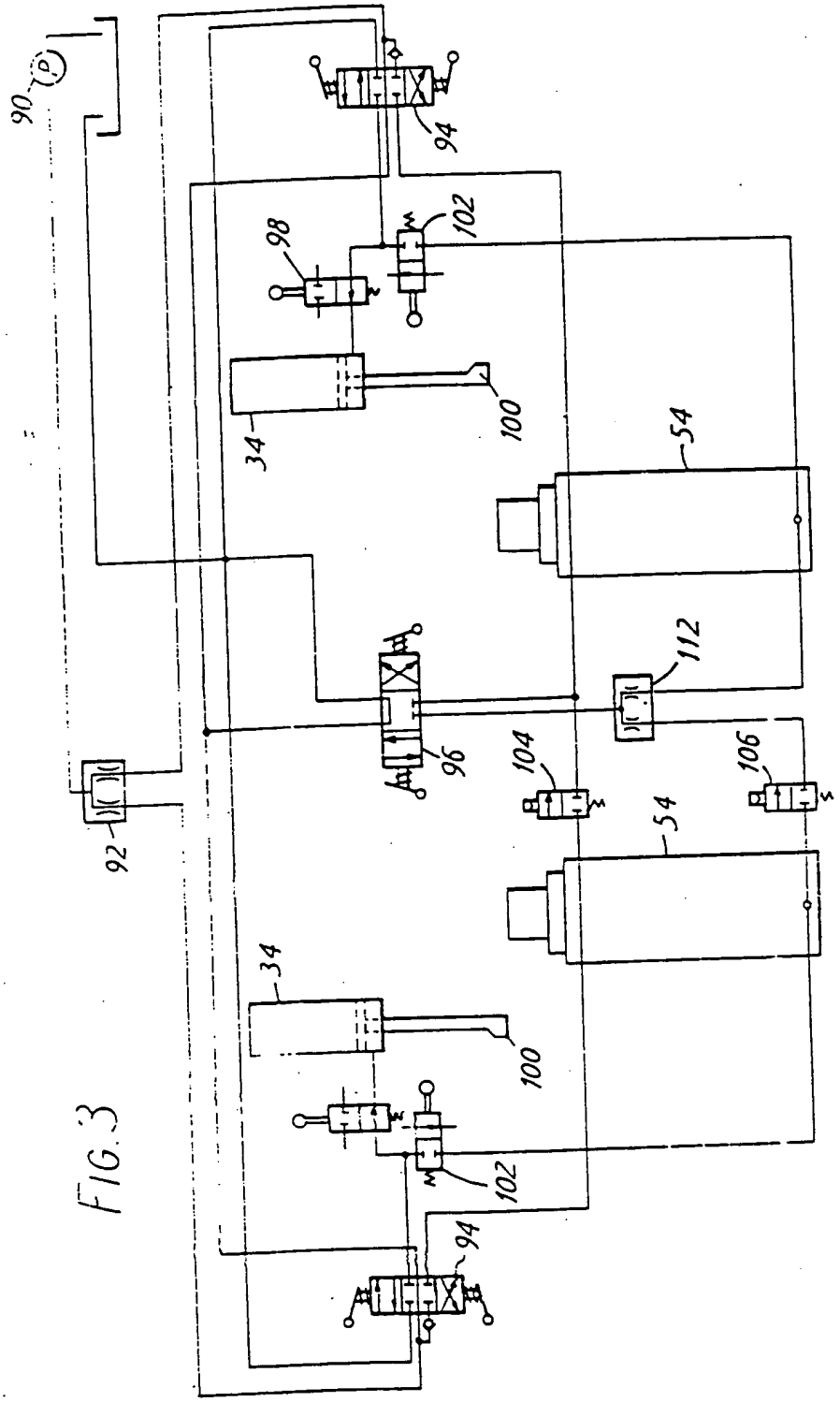


FIG. 3

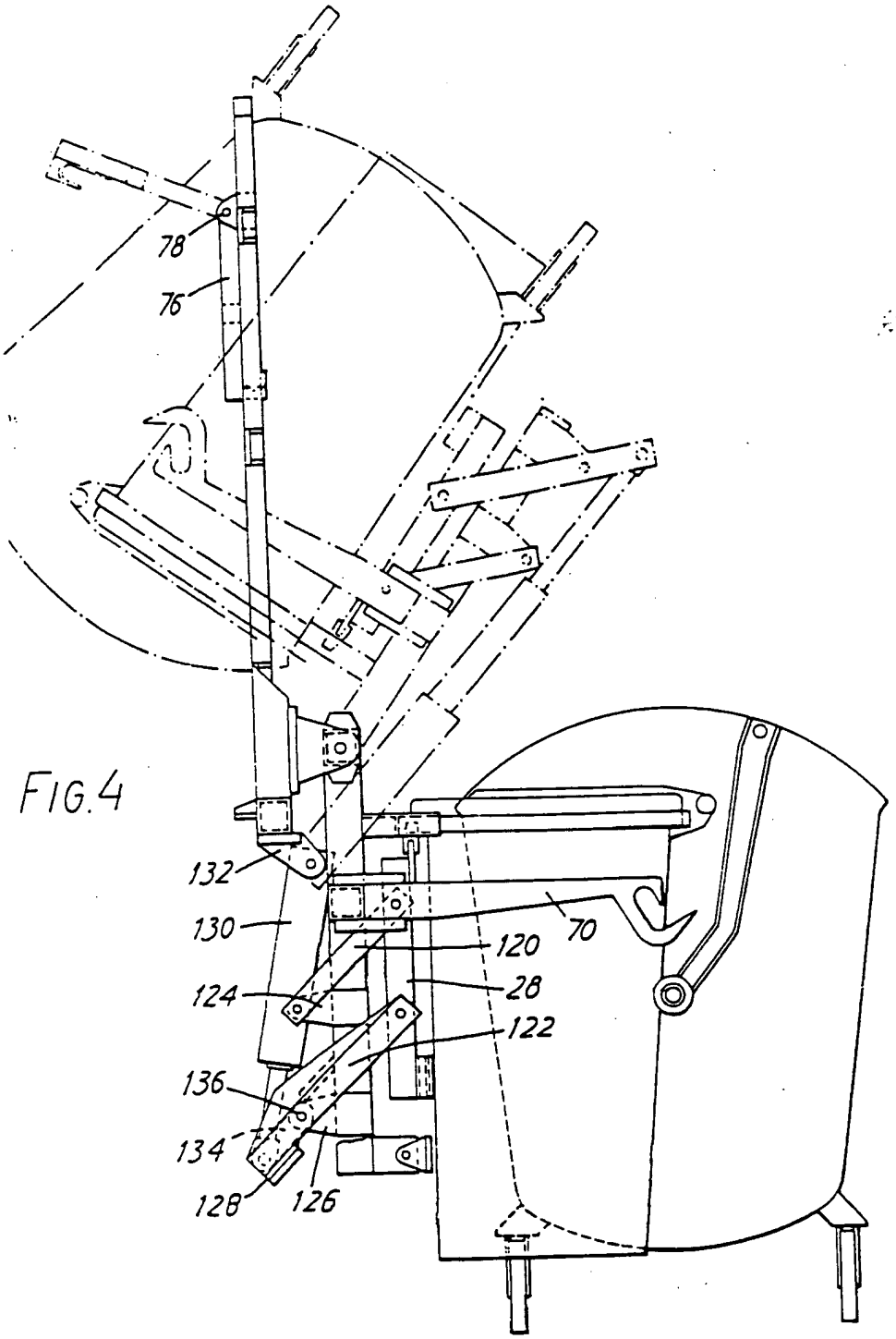
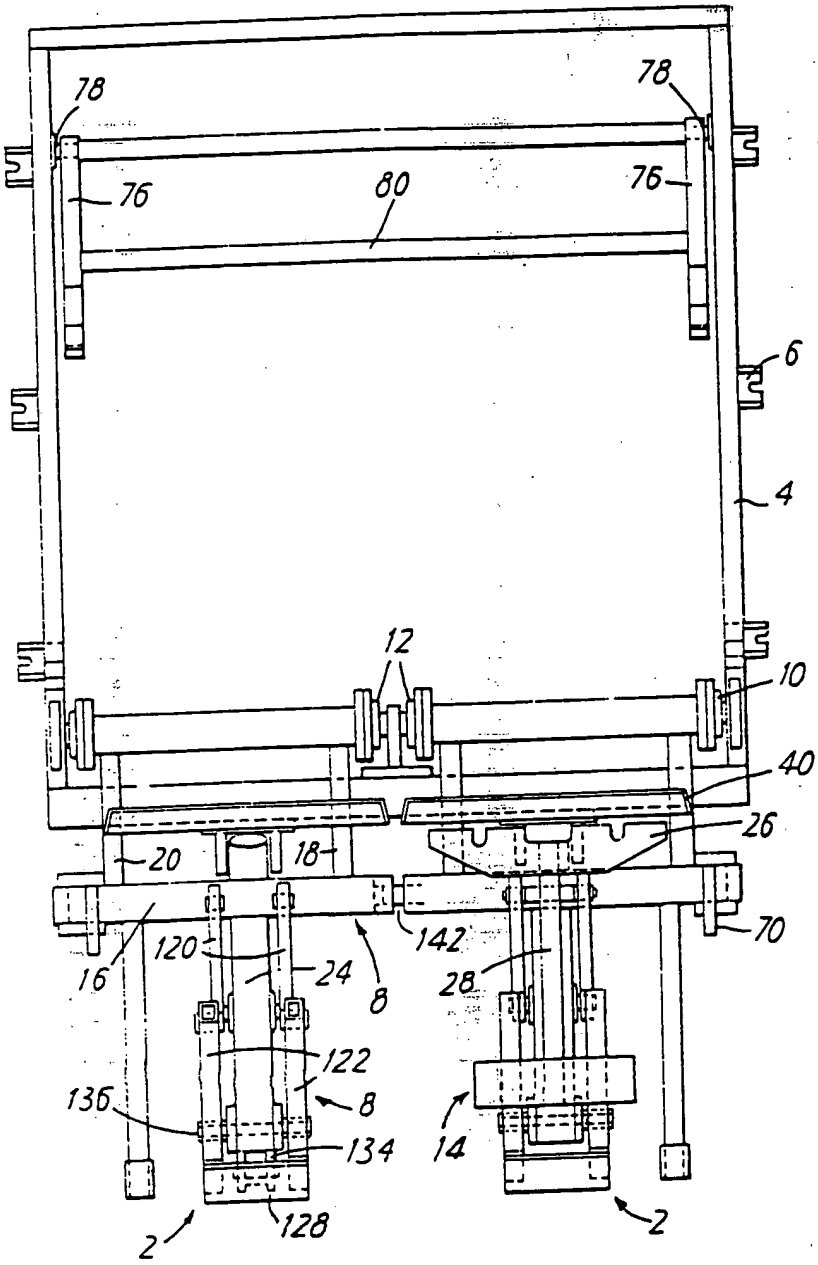


FIG.4

FIG.5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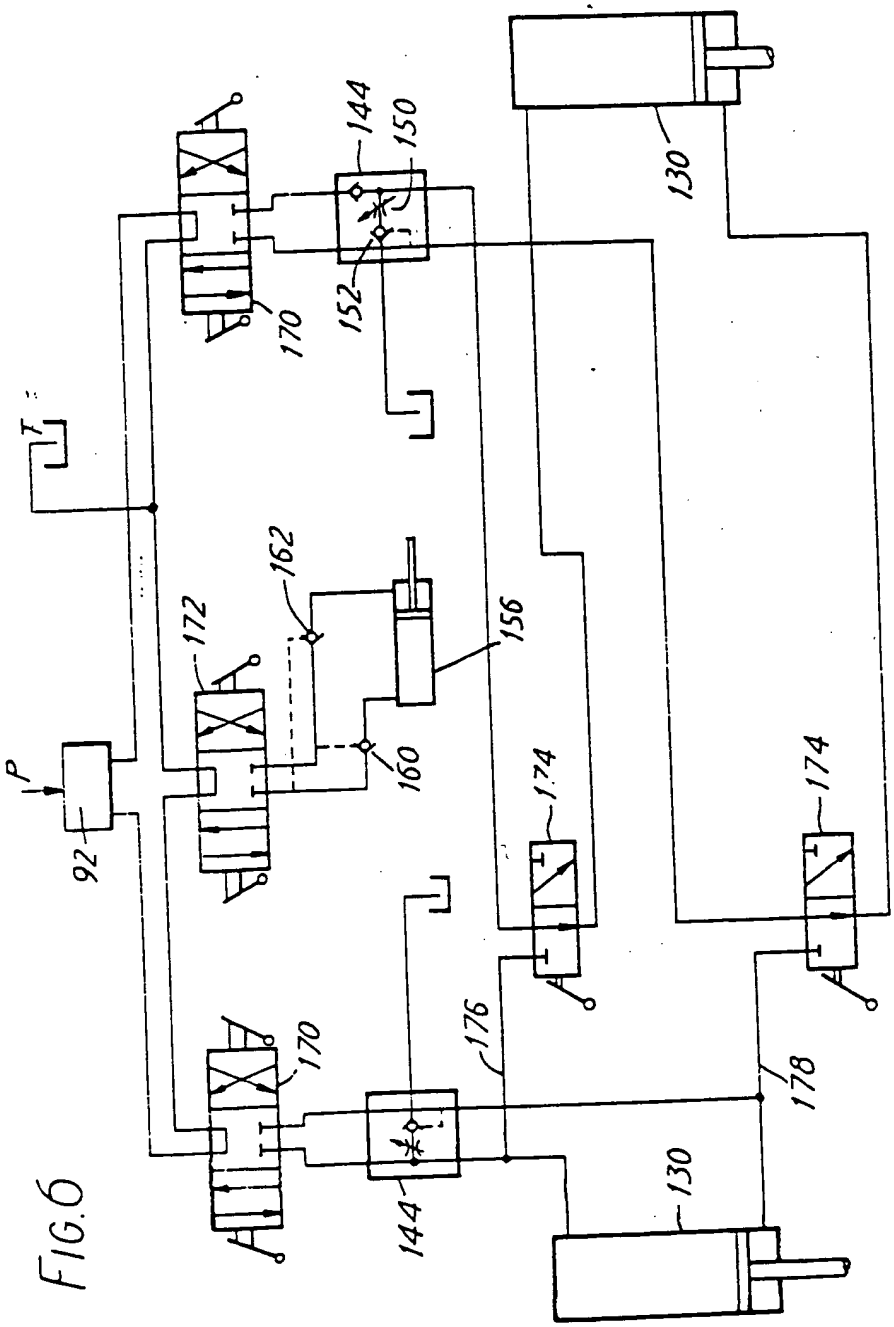
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FIG.6

SPECIFICATION

Raising and tipping mechanisms

This invention relates to lifting and tipping arrangements for refuse bins (the term "bin" being understood herein to embrace material containers of any form for the collection or disposal of refuse), e.g. for use on refuse collecting vehicles.

It has become common to provide refuse collecting vehicles with powered arrangements that can lift and tip a loaded refuse bin to empty its contents into the vehicle. This can greatly increase the rate of working, but it is necessary to use a standard size of bin that is matched to the lifting and tipping arrangement. It can then be extremely inconvenient to use the vehicle to collect refuse from any other form of bin, particularly as the lifting and tipping mechanism will usually obstruct the opening to the vehicle entry hopper, even when it is inoperative.

It is known to deal with this difficulty by putting the lifting and tipping arrangement on a detachable mounting frame. At the vehicle depot the frame can then be secured in place over the vehicle hopper opening before a collection round and on another day it can be replaced by another frame having a lifting and tipping arrangement for another form of bin. This is not an ideal solution, however, because the use of each bin type may not be confined to discrete geographical areas: for example, shops and blocks of flats provided with very large bins may be interspersed among neighbouring smaller dwellings where smaller bins are used. It is therefore necessary for the vehicle to cover the same ground on different days in order to deal on each occasion with those bins that are appropriate to the particular lifting and tipping arrangement that has been fitted to the vehicle on that day.

According to the present invention, there is provided a bin lifting and tipping arrangement comprising a plurality of lifting and tipping devices for a first form of bin and each having a respective drive means, and also comprising means for engaging a further form of bin larger than said first form, and said drive means or a plurality of said drive means being arranged to actuate said engagement means jointly to perform a lifting and tipping movement of said larger form of bin.

According to a further aspect of the invention, there is provided a bin lifting and tipping arrangement comprising two lifting and tipping devices disposed side-by-side and each provided with independently operable drive means for lifting and tipping respective first bins independently of each other, there also being provided means for engagement of a further bin larger than a first bin and arranged to be operated by both said drive means acting jointly.

In an arrangement according to the invention, each drive means may comprise a lifting and tipping fluid pressure motor with valve means to permit said motors of both or at least two drive means to be supplied with pressure fluid either independently or jointly. Said motors can be arranged to act upon respective lifting and tipping frames for said first bins and a mechanical interconnection can be provided between said frames for said larger further bin to be lifted and tipped by both frames moving in synchronism. Advantageously the frames and the motors are interlinked simultaneously.

Conveniently, engagement elements for said further bin are disposable in a retracted position when the lifting and tipping devices of the first bins are to be utilised for such bins. Actuation means may be provided to be operated in the movement of said engagement elements to their operative position to cause the circuits of the respective motors to be actuated so that the motors operate in unison for said further bin.

In one form of the invention, a particularly simple arrangement is achieved by utilising the same motor in each lifting and tipping device both for gripping a bin, where this is required, and for actuating the lifting and tipping movements.

Preferably, the respective lifting and tipping means and their drive means are mounted on a support frame that is adapted to be detachably secured over an entry opening of a hopper or container for a refuse collecting vehicle body.

The invention will be described in more detail by way of example with reference to the accompanying drawings wherein:—

Figs. 1 and 2 are side and rear views respectively of a bin lifting and tipping arrangement according to the invention mounted over a rear loading hopper opening of a refuse collecting vehicle, in Fig. 2 one of the two bin mountings being omitted to show some details better,

Fig. 3 illustrates the hydraulic circuit of the arrangement in Figs. 1 and 2,

Figs. 4 and 5 are side and rear views of a modified form of bin lifting and tipping arrangement according to the invention, and

Fig. 6 illustrates the hydraulic circuit of the arrangement in Figs. 4 and 5.

The illustrated embodiments of the invention are designed to deal with three different types of bin, these consisting of two similar standard types, indicated by the reference A, with 120 litre and 240 litre capacities respectively, of the kind having a modified square plan form (i.e. a square shape with slightly rounded sides and radiussed corners), and a third type indicated by the reference B, the 1.1 cbm size of bin of DIN 30 700. For the two former types of bin, which are of similar form but different proportions, the arrangement has two separately lifting and tipping devices 2 mounted side-by-side. The third type of bin is considerably larger and of rather different configuration, and use is made of both the said devices to lift and tip such a bin, as will be described below.

The devices 2, including the major part of the hydraulic circuit that operates them (but not the pump and reservoir) are mounted on a support frame 4 that is detachably bolted through lugs 6 as a unit to the rear of a refuse collecting vehicle V

over the entry to the hopper body. Within the hopper there is a packing mechanism (not shown) to transfer discharged material into a main load-carrying body: this may be constructed in the manner described in our UK Patent Specification 1588133 and will not be described in detail.

The arrangement illustrated will first be described with reference to the first two types of bin A. Each of the lifting and tipping devices is similar (although some parts are left- handed or right-handed) and each comprises a lifting and tipping carrier 8 mounted on pivot blocks 10, 12 of the support frame to be pivotable about a horizontal transverse axis, and a bin mounting 14 that is upwardly and downwardly displaceable on the carrier.

The carrier comprises a frame having a pair of horizontal cross-members 16 connected by vertical side members 18, 20. Spigots 22 of the carrier pivot mounting project from the side members near their upper ends into the blocks 10, 12. The frame also has a central member 24 extending downwards from the lower cross-member for attaching the bin mounting 14. The bin mounting itself comprises a generally T-form frame with a top cross-bar 26 and a dependent central member 28. Pairs of stub shafts 30 on the central member of the carrier and the bin mounting are journalled in pairs of tubular links 32 that connect the carrier and bin mounting and form a parallelogram linkage so that the bin mounting can move upwards or downwards while its central member 28 remains parallel to the carrier central member 24. For this movement a secondary hydraulic ram 34 is connected between the carrier and pivot attachments 36 in the middle of the lower pair of links.

The carrier 14 also comprises a holding member 40 that is substantially U-shaped, with a central part spaced rearwards of the carrier frame and extending across the width of the frame, and a pair of rearwardly projecting arms 42, 44 at opposite ends of the central part, the inner arm 42 being considerably shorter than the outer arm 44. The holding member is of angle section with a horizontal flange 46 uppermost and a dependent oblique lower flange 48 on the outer periphery of the U-shaped member.

When the ram 34 is extended the foot of the mounting is brought to or close to the ground. When it is contracted as shown, the top cross-bar 26 of the bin mounting is brought immediately underneath the horizontal flange of the central part of the holding member 40. In use, this allows the mounting to lift a bin A that has been offered to the device and to grip the upper rim of the bin between the top cross-member and horizontal flange. To assist the engagement, a series of plastics pads 52 are mounted on the cross-member, the spaces between the pads corresponding to the positions of reinforcing gussets (not shown) on the bin projecting below its top rim.

With the bin firmly gripped, the carrier can be rotated on its pivots 10, 12 by a main ram 54, connected between a lug 56 at the top of the lower cross-member and a pair of lower extensions 58 on the support frame 4. The bin is then lifted and tipped, and during this movement supplementary support is provided by bearer pads 60 at the bottom of the bin mounting central member 28.

In use, a 120 litre or 240 litre bin is wheeled into place while the bin mounting 14 is in its lowered position, with its ram 34 fully extended. The ram is then contracted to engage the bin mounting cross-bar 26 under the top flange of the bin body and lift the bin a short distance until it is clamped firmly between the cross-bar 26 and the holding member 40 on the carrier 8. In the case of a 240 litre bin, both arms 42, 44 of the holding member engage opposite side regions of the bin top rim. The smaller 120 litre bin is so positioned that the top flange is gripped by the central part of the holding member and the longer, outer arm 44 only.

During the lifting and tipping movement, extension of the ram 54 brings the carrier to the position indicated in broken lines at 8a in Fig. 1. The bin lid will swing open by gravity and the contents of the bin are directed by a shield plate 68 on the carrier, co-operating with a chute mounted at the vehicle body opening, into the vehicle hopper. When the movement is reversed, the bin is of course first returned to the upright position by contraction of the main ram 54 before the secondary ram 34 extends to release the grip of the rim of the bin and lower it to the ground.

Each of the two bin lifting and tipping devices 2 can be operated independently in the manner described but when emptying a standard 1.1 cbm bin B, both carriers 8 are displaced in synchronism.

To engage such a bin, the outer members 20 of the carrier frames are each provided with a retractable engagement arm 70 that can be swung downwards from the chain-dotted position 70a shown in Fig. 1 to a rearwardly extending operative position shown in full lines. The hooked ends 72 of these arms can then be engaged in projections at the sides of the bin and by extending the two main rams 54 the bin is lifted and tipped, to empty its contents into the hopper. There is no preliminary raising and clamping action required in this instance. During the tipping movement the bin is steadied by pivoted support pads 74 on the lower ends of the members 20 which can engage the forward corner regions of the bin. Although they appear in Fig. 1 to project rearwards beyond the line of the alternative form of bin A, they are so set laterally of the carrier that they do not foul the smaller bins.

The standard 1.1 cbm bin concerned has a sliding lid that pivots on the body and this is opened during the tipping movement by a pair of hook arms 76 having pivots 78 on a common axis near the top of the support frame 4 and connected by a torsion bar 80 to swing together. Pins on the bin lid engage hooks 82 on the arms as the bin tips past them and the lid is held back by the arms

as the tipping movement is completed so that it slides on the bin body to the open position, at the same time swinging the arms forwards. As the bin is returned, the arms are moved back by biasing springs 84 to close the lid, eventually automatically, coming free of the lid as they approach their end position.

To screen the hopper entry a first rubber curtain 86 is attached between the top of the support frame and the bar 80. A second rubber curtain 88 hangs from the bar 80 to reach to near the bottom of the hopper entry when the bar is in its lowered position and is simply pushed back by a smaller bin when that is tipped.

There will now be described with reference to Fig. 3 a hydraulic circuit by means of which the operations described above are performed. In the circuit, a pressure feed line from pump 90 goes first to a flow divider 92 where the flow is split into two equal parts to go to respective similar sub-circuits of the lifting and tipping devices for the smaller bins in such a way that the available flow to each is unaffected by the other.

Each sub-circuit has a manual three-position control valve 94 that is spring-loaded to park in the illustrated middle position. The pressure flow is then allowed to go directly through the control valve, and via porting in a further control valve 96, similarly spring-loaded to a parking position, the flow returns to reservoir.

The secondary ram 34 of each device is single acting but is gravity-biased to an extended position. When the spool of its control valve 94 is moved upwards, the pressure fluid is directed through a normally open selector valve 98 to contract the secondary ram and raise the bin mounting that thereby raises and grips a bin that has been put in position under the holding member. As the bin mounting reaches the end of its movement and the bin is gripped, a cam 100 switches a second, normally closed selector valve 102 to allow pressure fluid through the line to the associated main ram 54 which extends to raise and tip the bin. The first selector valve 98 is also switched by a cam (not shown) to close it as the main ram begins to tip the bin, i.e. momentarily later than the operation of the cam 100, and so isolate the pressure fluid in the secondary ram to hold the ram contracted and the bin firmly gripped by the bin mounting 14.

It will be noted that the presence of normally closed, pneumatically operated isolator valves 104, 106 confined the flow of pressure fluid through either control valve to the main ram of its associated sub-circuit even though there are fluid lines between corresponding ends of the two main rams.

When the spool of the control valve 94 is moved to its lowermost position, the connections to the main ram are reversed and the tipping frame returns. The first selector valve 98 is switched again by its cam at the end of the tipping movement, so that the space under the piston in the secondary ram is connected to exhaust and the ram is allowed to extend as the now upright bin descends to the ground by gravity. As the bin begins to be lowered, the second selector valve 102 returns to its normally closed position leaving the main ram contracted.

When a larger bin B is to be tipped, the engagement arms 70 are extended to be actuated by both main rams operating together. It can be arranged that the pivoting of the arms to their operative positions on the carriers automatically changes the hydraulic circuit over to the appropriate mode by actuating a pneumatic control valve (not shown) that admits pressure air to the isolating valves 104, 106 so that the two main rams have corresponding ends directly interconnected, and by extending a pneumatic cylinder 108 to connect a linking pin 110 between the lower members 16 of the two carriers 8 so that they are rotationally fixed to one another.

The control valves 94 are in their parked positions, so pressure fluid is admitted directly to the further control valve 96. When that is switched (to the right) the fluid can flow to both main rams, through a second flow divider 112 that splits the flow equally. The rams then extend to pivot the engagement arms to the broken-line position 70b seen in Fig. 1, so tipping and emptying the bin B. In this mode, the operation of the secondary rams 34 is bypassed. The main rams are double acting and switching the further control valve 96 to its opposite end position therefore applies pressure fluid to contract them and return the emptied bin to its original position.

In the modified arrangement shown in Figs. 4 and 5, parts corresponding to those described in connection with Figs. 1 and 2 will be generally indicated by the same reference numbers and will not be further described. A principal difference in this alternative construction is that it has been simplified by the omission of the secondary hydraulic rams 34 for the two lifting and tipping mechanisms 2 for the 120 litre and 240 litre bins.

Each of the bin lifting and tipping carriers has its T-form bin mounting 14 supported on it through pairs of parallel links 120, 122 pivoted to lugs 124, 126 on the carrier frame and to the central member 28 of the bin mounting. These links form a parallelogram linkage similarly to the first described example. The lower links 122 are part of a rigid U-frame of each carrier, being connected at their lower ends by a bridge piece 128.

A driving ram 130 is pivoted at the upper end of its cylinder to the support frame 4 through lugs 132. At its lower end the ram piston rod is connected by a short pivot link 134 to the same pivot 136 as that between the links 122 and the lugs 126 on the carrier frame. Although the link 134 is free to pivot, its anticlockwise movement about the pivot 136 is limited by abutment with the bridge piece 128.

When the ram 130 is fully contracted, the link 134 is pivoted away from the bridge piece 128 and the cross-bar 26 of the bin mounting is held below the holding member 40 (here shown with rather shorter rearwardly projecting arms) of the

carrier 8. The initial extension of the ram swings the link 134 down to bear against the bridge piece 128, and after this initial lost motion the force of the ram acts to raise the cross-bar 26 to the illustrated position. Once further movement of the cross-bar is blocked by direct contact with the holding member, or by the engagement of a bin rim between it and the holding member, continued extension of the ram 130 swings the carrier 8 through its raising and tipping movement. The first part of the extension of a ram 130 therefore fulfils the function of a ram 34 of the first-described embodiment and the remaining movement of the ram 130 fulfils the function of a ram 54.

For the return movement of the bin, the initial contraction of the ram simply swings the pivot link 134 away from the bridge piece 128 and the ram then acts directly through the pivot 136 to swing the bin carrier downwards. The bin mounting 14 will remain in its raised position relative to the carrier, so it can continue to grip the rim of an engaged bin, until the carrier frame has swung down sufficiently past the horizontal to allow gravity to lower the bin, which will then be adequately supported by the bin mounting until it reaches the ground.

For operation with a 1.1 cbm bin the two carrier frames are provided with the engagement arms 70, which in this instance are retracted by pivoting inwards to lie against their respective frames. The frames are linked together by extension of a locking pin 142 and both rams 130 are operated in synchronism for this mode of use, as already described in the first embodiment. The initial extension of the rams lifts the bin mountings until each cross-bar 26 engages its holding member 40, and thereafter the carrier frames being to move to lift and tip the bin in the manner already described.

By the use of the same ram or rams to both lift the bin mounting and to raise *and* tip of the carrier frame, the hydraulic circuit can be considerably simplified. The circuit for the arrangement shown in Figs. 4 and 5 is illustrated in Fig. 6 and also incorporates a hydraulic interlock for coupling together the two carrier frames by a retractable locking pin 124: this is in place of the pneumatic interlock described in the first embodiment and could be used there also.

In the circuit of Fig. 6, the pressure feed through the flow divider 92 goes to respective three-position control valves 170 that are spring-loaded to park in the central position as illustrated but can be manually displaced to either end position. The return flow also passes through these valves to a low pressure reservoir. From each valve 170, the supply and *return* lines go their respective driving ram 130 by *way of a return* flow device 144. Each device 144 comprises a non-return valve 146 in the line to the space above the ram piston, and a branch 148 downstream of the valve 146 direct to the reservoir by way of a flow restrictor 150 and pilot-operated non-return valve 152. This last can be opened by full pressure in the line to the annular space below the ram piston. When the *ram* is being contracted, therefore, the valve 152 is open to allow the return flow from the space above the piston to bypass the restriction posed by the control valve 170 so that the operation of the ram is not retarded thereby.

A frame-joining ram 156 is provided to extend the locking pin 142 interconnecting the two bin carrier frames. The ram 156 is coupled to a third manually operated control valve 172 that is in the high pressure circuit when both control valves 170 are in their parked positions, but is spring-loaded to the illustrated parked position in which it isolates the frame-joining ram. Manual displacement of the valve 172 to one direction or the other either extends or contracts the ram 156 to displace the locking pin, and once the ram 156 has moved the locking pin to its required position the valve 172 can be allowed to return to the central position as the ram is isolated by pilot-operated non-return valves 160, 162 and the pin 142 has therefore been locked in its displaced position.

The circuit also includes two manually operated diverter valves 174 that are interposed in the supply and return lines respectively to one of the driving rams, the right-hand ram in the illustrated example. The diverter valve in the line to the space above the ram piston also has a connection 176 to the space above the piston of the other driving ram, and similarly, the diverter valve in the line to the annular space below the piston has a connection 178 to the space below the piston of that other ram. The diverter valves are preferably ganged to move together and are spring-loaded to the illustrated position, in which they permit flows to and from the right-hand cylinder but provide no passage for flow through the connections 176, 178. In this condition, both the control valves operate independently of each other on their respective driving rams.

When the diverter valves 174 are both switched from the positions shown, the right-hand driving ram is isolated from the right-hand control valve 170, and is instead connected to the supply and return lines through the left-hand control valve 170 by way of the connecting lines 176, 178. Operation of the left-hand control valve will therefore now displace both driving rams 130 together. Since both diverter valves are operated together, it would be possible to replace them with a single composite valve.

In operation, therefore with the diverter valves 174 in their illustrated position, each control valve 170 can be used to actuate its respective driving ram independently of the other, so as to operate the individual lifting and tipping frames for the smaller size refuse bins. Operation of the third valve 172 and the two diverter valves 174 (for which purpose it is possible to interconnect all three valves) puts the circuit into the mode in which both driving rams operate in synchronism to raise and tip the larger bins on the now interconnected tipping frames. Typically the valves 170 will be positioned on opposite sides of the support frame 4, adjacent their lifting and tipping

devices, and the valves 172, 174 can be switched by a control on that side from which the rams are operated jointly.

It will be understood that the valves 170, 172, 174 can be operated manually or by servo means, and that these alternatives are also available for the hydraulic circuit shown in Fig. 3. If servo means are used, it is also possible to provide corresponding operating controls on each side of the rear of the vehicle that include, in addition to a ram control lever a switch that will actuate the extension of the frame-joining ram and interconnect the two rams. The ram control lever on the selected side would then be used to operate both rams 130 in synchronism to lift the larger form of bin. Operating a second switch would restore the controls on each side to independent operation so that use of each ram control lever will actuate its adjacent ram independently of the other ram, and each bin carrier will thus be operable to lift smaller bins by use of its own control lever.

Many modifications may be made to the illustrated embodiments within the scope of the invention. In addition, although the illustrated embodiments refer to specific standard forms of bin, it will be understood that the invention can be applied to the raising and tipping of bins of other forms if required.

CLAIMS

1. A bin lifting and tipping arrangement comprising a plurality of lifting and tipping devices for a first form of bin each having a respective drive means, and also comprising means for engaging a further form of bin larger than said first form, and said drive means or a plurality of said drive means being arranged to actuate said engagement means jointly to perform a lifting and tipping movement of said larger form of bin.

2. A bin lifting and tipping arrangement comprising two lifting and tipping devices disposed side-by-side and each provided with independently operable drive means for lifting and tipping respective first bins independently of each other, and that there are means for engagement with a further bin larger than a first bin and arranged to be operated by both drive means acting jointly.

3. An arrangement according to claim 1 or claim 2 wherein each drive means comprises a fluid pressure motor and valve means are provided to permit said motors of both, or of at least two, drive means to be actuated either independently or jointly.

4. An arrangement according to any one of claims 1 to 3 wherein the lifting and tipping devices are provided with interconnection means that are operative when said larger form of bin is to be lifted and tipped by both frames moving in unison.

5. An arrangement according to claim 4 wherein the interconnection means comprises an engagement member that is locked in position after each movement.

6. An arrangement according to claim 3 together with claim 4 or claim 5 wherein interlinking means are provided to simultaneously interconnect the lifting and tipping devices and connect the motors to fluid pressure lines for joint operation.

7. An arrangement according to any one of the preceding claims wherein engagement elements for said further bin are disposable in a retracted position when the lifting and tipping devices are to be utilised for the first form of bin.

8. An arrangement according to claim 7 wherein movement of the engagement elements to their operative position also operates actuation means that cause the lifting and tipping devices to be so interconnected that the drive means raises and tips them in unison for emptying said further form of bin.

9. An arrangement according to any one of the preceding claims wherein each lifting and tipping device for the first form of bin comprises a pivotably mounted frame and a bin mounting displaceable on said frame to grip a first form of bin that is to be lifted and tipped by the frame.

10. An arrangement according to claim 9 wherein a common drive motor displaces said mounting and pivots the frame.

11. An arrangement according to claim 10 wherein the drive motor operates through a lost motion connection with said frame, whereby during the return movement of the lifting and tipping means the bin mounting is left free to move by gravity to release the bin as the frame pivots back from an inverted position.

12. An arrangement according to claim 9 wherein each lifting and tipping device has a first fluid motor for pivoting the frame and a second fluid motor for displacing the bin mounting on the frame, there being sequencing means for said motors when tipping a first form of bin, and bypass means for bypassing the second fluid motors when tipping a second form of bin.

13. An arrangement according to claim 7 or claim 8 together with any one of claims 9 to 12 wherein the engagement elements are pivotable towards each other to an inoperative position lying between the frames and the mountings.

14. An arrangement according to any one of claims 3 to 13 when dependent to claim 2 wherein operating controls are provided at opposite sides, each for the respective lifting and tipping devices, and each comprises means for the joint operation of both devices jointly that isolate the control for the operation of the other individual device.

15. An arrangement according to any one of the preceding claims wherein the lifting and tipping devices are mounted on a demountable

support frame.

16. A bin lifting and tipping arrangement constructed and arranged for use and operation substantially as described with reference to the examples shown in Figs. 1 to 3 and Figs. 4 to 6 of the accompanying drawings.

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